

Flip Chip Packaging of a MEMS Neuro-Prosthetic System

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A joint research team from California Institute of Technology and Jet Propulsion Laboratory is developing a fully miniaturized, smart implantable neuro-prosthetic system, by combining integrated electronics with Micro Electro Mechanical Structure (MEMS) based electrode arrays. The packaging group of this project team has been tasked with designing and fabricating a package to interface electrically between a MEMS electrode array, capable of extracting signals from brain, and an electronic chip, capable of providing on chip conditioning/processing of extracted data, while delivering the output data to a detector located outside the body. Area array flip chip technology will be used to attach the electronic chip and the MEMS device (10 x 10 array of fine 1 mm long, electrically isolated Si electrodes). Development efforts included evaluation of different interconnects, underbump metallizations, and underfills as well as optimization of soldering and coating parameters. Some specific challenges of the project include (1) handling of the MEMS array in a way that will allow reliable soldering of the fine 4 mil joints, without damaging the delicate structures and (2) selection of underfills and coatings capable of isolating the electronics from the body, while maintaining biocompatibility.